

## **CLAIMS:**

The invention is claimed as follows:

1. A system for providing dialysis comprising:  
a patient fluid loop including a first pump and multiple patient lumens;  
5 a second fluid loop including a second pump and a medical fluid regenerator;  
a membrane device in fluid contact with and separating the patient fluid loop  
and the second fluid loop, the membrane device allowing at least one selected  
component of the fluid in the patient fluid loop to transfer to the second fluid loop;  
the second loop being closed except for the transfer of the selected component  
10 via the membrane device; and  
a controller that operates the first and second pumps to recirculate fluid in the  
patient loop and the second loop.
2. The dialysis system of Claim 1, wherein the membrane device is a  
15 dialyzer.
3. The dialysis system of Claim 1, wherein a pressure gradient exists  
across the membrane device.
- 20 4. The dialysis system of Claim 1, wherein the patient loop is closed  
except for the transfer of the selected component via the membrane device.
5. The dialysis system of Claim 1, wherein the membrane device includes  
a nanofilter which allows urea to pass from the patient fluid loop to the second fluid  
25 loop.
6. The dialysis system of Claim 1, wherein the medical fluid regenerator  
includes a uremic toxin sorbent.
- 30 7. The dialysis system of Claim 1, wherein the medical fluid regenerator  
includes at least one of: urease, zirconium phosphate, zirconium oxide, and carbon.

8. The dialysis system of Claim 1, which includes a gas separator that removes gas from at least one of the patient and second fluid loops.

9. The dialysis system of Claim 8, wherein the gas separator and the  
5 medical fluid regenerator are provided in a single device.

10. The dialysis system of Claim 1, which includes a gas vent that vents gases from the patient and second fluid loops.

10 11. The dialysis system of Claim 1, wherein the second fluid loop includes a multi-analyte sensor that monitors a concentration of electrolytes in the medical fluid.

12. The dialysis system of Claim 1, wherein peritoneal dialysis fluid is  
15 circulated through the patient fluid loop.

13. The dialysis system of Claim 1, wherein blood is circulated through the patient fluid loop.

20 14. The dialysis system of Claim 1, wherein at least parts of the patient fluid loop and the second fluid loop are provided in a disposable device.

15. The dialysis system of Claim 1, wherein the second fluid loop includes a balance chamber that balances flow within the second fluid loop.

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16. The dialysis system of Claim 1, wherein the controller enables fluid to flow in opposite directions through the multiple patient.

17. The dialysis system of Claim 1, which includes a dual lumen catheter  
30 that defines the multiple patient lumens.

18. The dialysis system of Claim 1, wherein at least one of the patient fluid loop and the second fluid loop includes an in-line fluid heater.

19. The dialysis system of Claim 18, wherein the in-line fluid heater includes a radiant heater and a plate heater.

5           20. The dialysis system of Claim 1, which includes at least one medical fluid sensor that senses at least one indicator selected from the group consisting of: ammonia, ammonium and pH.

21. The dialysis system of Claim 1, which includes a fluid volume sensor in  
10 at least one of the patient and second fluid loops.

22. The dialysis system of Claim 21, wherein the fluid volume sensor includes a capacitance fluid volume sensor that uses a chamber in fluid communication with the at least one fluid loop.

15           23. The dialysis system of Claim 22, wherein the chamber is a pump chamber.

24. The dialysis system of Claim 1, which includes an ultrafiltrate container  
20 in fluid communication with at least one of the patient and second fluid loops.

25. The dialysis system of Claim 1, which includes a fluid concentrate container in fluid communication with at least one of the patient and second fluid loops.

25           26. The system of Claim 1, wherein the controller operates the first pump continuously to pump fluid into and out of a patient.

27. A disposable dialysis cassette comprising:  
a flexible membrane covering a patient pump chamber and a regeneration pump chamber;  
means for fluidly connecting the patient pump chamber to a closed loop patient  
5 fluid path; and  
means for fluidly connecting the regeneration pump chamber to a closed loop regeneration fluid path, wherein the patient path fluidly communicates with the regeneration path via a dialyzer.
- 10 28. The disposable dialysis cassette of Claim 27, which defines a fluid path that fluidly communicates with a dialysate sorbent cartridge.
29. The disposable dialysis cassette of Claim 27, which defines a fluid path that fluidly communicates with a gas separator.
- 15 30. The disposable dialysis cassette of Claim 27, which defines a fluid path that fluidly communicates with a dialysis concentrate container.
31. The disposable dialysis cassette of Claim 27, which defines a fluid path  
20 that fluidly communicates with a dialysate last bag.
32. The disposable dialysis cassette of Claim 27, which defines a fluid path that fluidly communicates with a dialysate bag.
- 25 33. The disposable dialysis cassette of Claim 27, which defines a fluid path that fluidly communicates with a drain container.
34. The disposable dialysis cassette of Claim 27, which defines a fluid path that fluidly communicates with a patient fluid connector.
- 30 35. A dialysis therapy device for use with a disposable cassette, the device comprising:

a housing having a portion that receives the disposable cassette;  
a patient pump actuator in the housing that pumps fluid through a patient path defined at least in part by the disposable cassette; and  
a regeneration pump actuator in the housing that pumps fluid through a  
5 regeneration path defined at least in part by the disposable cassette.

36. The dialysis therapy device of Claim 35, which includes at least one fluid volume measurement sensor component that cooperates with at least one of the patient pump actuator and the regeneration pump actuator.

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37. The dialysis therapy device of Claim 35, wherein the housing houses a fluid heater.

38. The dialysis therapy device of Claim 35, wherein the housing houses at  
15 least one sensor selected from the group of: an ammonia sensor, an ammonium sensor and a pH sensor.

39. The dialysis therapy device of Claim 35, wherein the housing houses at least one valve actuator that operates with the disposable cassette.

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40. A method of moving fluid in a dialysis system comprising the steps of:  
continuously recirculating a first fluid through a patient loop;  
continuously recirculating a second fluid through a regeneration loop;  
transferring at least one waste component from the patient loop to the  
25 regeneration loop through a device shared by both loops, the loops being closed except for said transfer through said device; and  
removing the at least one waste component from the regeneration loop.

41. The method of Claim 40, wherein the first and second fluids include  
30 dialysate.

42. The method of Claim 40, wherein the first fluid includes blood and the second fluid includes dialysate.

43. The method of Claim 40, wherein removing the waste component includes flowing the second fluid in the regeneration loop through a waste sorbent and absorbing at least some of the waste component.

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44. The method of Claim 40, which includes the step of heating the at least one of the first and second fluids.

45. The method of Claim 40, which includes the step of removing  
10 ultrafiltrate from at least one of the first and second fluids.

46. The method of Claim 40, which includes the step of adding dialysate to at least one of the first and second fluids.

15 47. The method of Claim 40, which includes the step of adding concentrate to at least one of the first and second fluids.

48. The method of Claim 40, which includes the step of removing gas from at least one of the first and second fluids.

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49. The method of Claim 40, which includes the step of balancing the flow of fluid in at least one of the patient loop and the regeneration loop.

50. The method of Claim 40, which includes the step of sensing a volume  
25 of flow of fluid in at least one of the patient loop and the regeneration loop.

51. A method of moving fluid in a peritoneal dialysis system comprising  
30 the steps of:

continuously recirculating dialysate through a container in a patient loop;

continuously recirculating dialysate through the container in a regeneration loop; and

continuously moving at least one waste component from the patient loop to the regeneration loop through the container shared by both loops, the loops being closed except for the transfer through the container.

5           52.    The method of Claim 51, which includes the step of recirculating dialysate through the regeneration loop at a different rate than a rate at which dialysate is recirculated through the patient loop.

10           53.    A method of performing continuous flow peritoneal dialysis comprising the steps of:

continuously recirculating dialysate fluid through a closed patient loop;  
continuously recirculating regeneration fluid through a closed regeneration loop;

15           passing the dialysate fluid and the regeneration fluid past opposite sides of a dialyzer membrane; and

regenerating the regeneration fluid after the regeneration fluid exits the dialyzer.

20           54.    The method of Claim 53, wherein recirculating dialysate fluid through the closed patient loop includes passing the fluid through a portion of a patient.

55.    The method of Claim 53, wherein recirculating dialysate fluid through the closed patient loop includes passing the fluid through a sleeping patient.

25           56.    The method of Claim 53, wherein recirculating dialysate fluid through the closed patient loop includes passing the fluid through a patient at nighttime.

57.    A method of performing continuous flow dialysis comprising the steps of:

30           performing continuous flow peritoneal dialysis with a closed loop dialysis device at a first point in time; and

performing continuous flow hemodialysis via the same closed loop dialysis device at a second point in time.

58. The method of Claim 57, wherein the continuous flow peritoneal dialysis and the continuous flow hemodialysis are performed on the same patient.

5 59. The method of Claim 57, which includes an intermediate step of removing a disposable cassette used with the device and coupling a new disposable cassette to the device.

60. The method of Claim 57, which includes an intermediate step of  
10 removing a dual lumen peritoneal dialysis catheter and replacing said catheter with a hemodialysis needle.

61. The method of Claim 57, which includes an intermediate step of  
removing a hemodialysis needle and replacing said needle with a dual lumen  
15 peritoneal dialysis catheter.